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Original Research Article

Echocardiographic Profile in Patients under Maintenance Haemodialysis

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Abstract:

Objective: To assess the prevalence of cardiovascular abnormalities in patients under maintenance hemodialysis.

Methods: Fourty six patients under maintenance hemodialysis were subjected to two-dimensional and M mode echocardiography. All patients were evaluated clinically, biochemically and radiologically and were diagnosed as chronic kidney disease (CKD). The left ventricular ejection fraction (LVEF) was taken as measures of left ventricular (LV) systolic function. Diastolic function was determined by measuring E/A ratio by spectral Doppler LV inflow velocity.

Results: Out of 46 patients studied, there were 36 males (78.27%) and 10 females (21.73%). Hypertension (60.86%) was leading cause of CKD. Echocardiography showed that left ventricular hypertrophy (LVH) was present in 71%. Systolic dysfunction as measured by decreased LVEF (< 50%) was present in 26.86%. Diastolic dysfunction as denoted by E/A ratio of less than 1 was present in 43.47% of patients. Regional wall motion abnormality (RWMA) was present in 13.04%. Pericardial effusion was noted in 23.08% of patients. Valvular calcification was noted in 10.86% patients. Mean left ventricular internal diameter in diastole was 34.30± 7.97 mm. Mean left atrium diameter was 38.57±5.83 mm.

Conclusion: Patients under maintenance hemodialysis had higher prevalence of cardiovascular abnormalities and echocardiogram is a complementary, non-invasive, broadly used method in the assessment of heart structure and function, and can detect cardiovascular abnormalities prior to clinical detection.

Keywords: Chronic Kidney Disease, Maintenance Hemodialysis, Echocardiography.

Introduction

Cardiovascular complications are the main cause of death in patients with chronic kidney disease (CKD) undergoing hemodialysis therapy [1]. The cardiovascular mortality in these individuals is 10- to 20-fold more frequent than in the general population [2]. Although more than 50% of the individuals starting a dialysis program present some type of pre-existent cardiovascular disease, the traditional risk factors for cardiovascular disease do not completely explain this excess risk, which seems to be influenced by the so-called non-traditional risk factors associated with CKD.

This set of factors accelerates the course of coronary artery disease (CAD) and is associated with a higher prevalence of ventricular hypertrophy, myocardial fibrosis, valvopathies, arrhythmias and sudden death [3]. The cardiomyopathy of the patient undergoing dialysis is mainly due to the presence of ischemic cardiopathy (by critical obstruction of the coronaries, decrease in coronary reserve or microvascular alterations) and morpho functional alterations of the left ventricle (LV) in response to pressure and volume overload. The physiopathology of the transformations induced by uremia in the left ventricular chamber is complex and multifactorial. [4] Arteriovenous fistula, which was used for vascular access in patients with ESRD, increases stroke volume load on the left ventricle and this may contribute to LVH and may results in LV systolic and diastolic dysfunction with time.

Also, the presence of an AVF reduces systemic vascular resistance. Studies after AVF closure because of complications suggest that AVF may leads to progression of LVH and high cardiac output heart failure. The diagnosis of LV abnormalities by Doppler echocardiography is an important step for

the characterization of individuals with higher cardiovascular risk, estimating the prevalence of primary heart disease in a population to study its predisposing factors, prognostic impact and the effect of therapeutic interventions [5].

The Doppler echocardiogram is a complementary, non-invasive examination, broadly used in the assessment of heart structure and function, bringing several ultra-sound techniques together in a single examination.

A Canadian study that followed a cohort of 432 patients starting hemodialysis therapy showed that only 16% had a normal Doppler echocardiogram. The finding of echocardiographic alterations, such as hypertrophy, dilatation and systolic dysfunction triples the risk of HF, regardless of age, diabetes and coronary failure [6].

The present study was aimed at assessing the prevalence of Left Ventricular Hypertrophy, Left Ventricular Systolic Dysfunction, Left Ventricular Diastolic Dysfunction, Left Atrial Dilatation, Valvular Calcifications, and Pericardial Disease by echocardiography patients under maintenance hemodialysis.

Material and Methods

Study population consisted of 46 patients under maintenance hemodialysis. The patients were evaluated by conventional and Doppler echocardiography. The patients were dialyzed via AVF three times a week for four hours.

Echocardiographic studies were performed by the same cardiologist in the left lateral position. Left ventricular end diastolic diameter (LVEDD), left ventricular end systolic diameter (LVESD) and septal posterior wall thicknesses were measured by M-mode in the parasternal long axis view and EF was calculated according to the Teicholz formula via these measurements. To evaluation of diastolic properties of the left ventricle, the mitral inflow velocities and Doppler tissue imaging (DTI) were evaluated from the apical four chamber view. Pulmonary vein flow velocities were obtained from the right posterior pulmonary vein in the apical view. The LA diameter was measured in the parasternal long axis view.

Diastolic filling is classified on the basis of the peak early (E) and late (A) diastolic mitral inflow velocities, E/A ratio, E wave deceleration time (DT) and isovolumic relaxation time. Right ventricle early (E) and late (A) ventricular inflow velocities were measured by pulsed wave Doppler placing the sample volume in between the tips of the tricuspid valve in the apical four chamber window.

Statistical Analysis: Statistical analyses were performed using the Statistical Package for the Social Science (SPSS). The categorical variables were shown as numbers of cases with percentage, and the continuous variables were shown as mean ± standard deviation (SD). A P value of ≤0.05 was considered statistically significant

Results

Demographic and clinical characteristics of the patients under maintenance hemodialysis are shown in Table 1. Mean age was 53.65 ± 10.5 years and 10 (21.73%) of the patients were female.

The most known causes of ESRD were diabetes mellitus and hypertension, respectively. Twenty eight of the 46 patients with ESRD were taking antihypertensive treatment.

Table 1: Demographic and clinical characteristics of patients under maintenance hemodialysis (n: 46)

Age (year)	**53.65 ± 10.5**
Male	36 (78.27%)
Female	10 (21.73%)
Presence of diabetes mellitus	15(32.6%)
Presence of hypertension	28(60.86%)
Smoking	16(34.7%)
BMI (kg/m^2)	27.3 ± 5.0
DBP	83 (60-90)
SBP	135(90-150)

Table 2: Baseline data of biochemical findings during HD treatment are shown

Parameter	**Mean ± standard deviation**
White blood cell count (mm^3)	7.4 ± 2.6
Hemoglobin (g/dL)	9.8 ± 1.4
Total cholesterol (mg/dL)	172.1 ± 40.9
Triglyceride (mg/dL)	139.8 ± 78.3
Blood urea nitrogen (mg/dL)	72.3 ± 32.4
Creatinine (mg/dL)	6.1 ± 3.3
Calcium (mg/dL)	8.1 ± 0.8
Phosphorus (mg/dL)	4.3 ± 1.4
Parathyroid hormone (pg/mL)	185(36-1289)

Table 3: The baseline echocardiographic measurements during maintenance HD treatment

Parameter	Mean ± standard deviation
LV end-diastolic diameter (mm)	34.30± 7.97
LV end-systolic diameter (mm)	51.00±7.88
LV ejection fraction (%)	59.6 ± 12.57
IVS end-diastolic diameter (mm)	13.96± 8.09
Left atrial diameter (mm)	38.57±5.83
Presence of LV hypertrophy	28 (71%)
E/A ratio	1.0 ± 0.4

Table 4: Echocardiographic abnormal findings in study cases

Echo findings	No. of cases	Percentage
Left ventricular hypertrophy	28	71%
Ejection fraction (< 50%)	12	26.86%
E/A ratio<1	20	43.47%
RWMA	6	13.04%
Pericardial effusion	10	23.08%
Valvular calcifaction	5	10.86%
Mitral Regurgitation	4	8.6%

Discussion

Premature cardiovascular disease is a significant cause of morbidity and mortality among patients with CKD. In this study LVH was present in 71%, systolic dysfunction was present in 26.86% of patients and diastolic dysfunction was observed in 43.47% by abnormal E/A ratio of CKD patients. Pericardial effusion was present in 23.08% patients.

Valve calcification and mitral regurgitation was noted in 10.86% and 8.6% respectively. Robert N. Foley et al (1995) had found abnormalities of left ventricular structure and functions were very frequent on baseline echocardiography: 73.9% had left ventricular hypertrophy, 35.5% had left ventricular dilatation and 14.8% had systolic dysfunction in ESRD patients. [7]

NP singh et al (2000) had found LVH in 76.92%, diastolic dysfunction in 72% but did not find systolic dysfunction in CKD patients. [8] Zoccali et al. (2000) had found 77% LVH, 22% systolic dysfunction by LVEF measurement in hemodialysis patients. [9] S.Agarwal et al (2003) had observed diastolic dysfunction in 60% and systolic dysfunction in 15% of patients. [10] The above findings were consistent with our study.

In conclusion, Cardiovascular abnormalities in patients undergoing hemodialysis were observed in large no of patients and LVH was the most common and left ventricular dysfunction was the second most cardiovascular abnormality. The Doppler echocardiogram is a complementary, non-invasive, broadly used method in the assessment of heart structure and function and can detect cardiovascular abnormalities prior to clinical detection.

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