Prevalence of left ventricular hypertrophy in end stage renal disease

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Abstract

Introduction: Cardiovascular disease (CVD) is still the major cause of death in patients with end stage chronic kidney disease (ES-CKD), with a mortality rate approximately 10 to 30 times greater than that of the general population. Advanced cardiomyopathy is caused by left ventricular hypertrophy (LVH) in patients with end stage kidney disease.

Objective: The objective of the study is to determine the prevalence of LVH in end stage renal disease (ESRD) patients.

Methods: This was a cross sectional study conducted at Department of Nephrology, Kulsom Bi Valika Social Security Site Hospital, Karachi. The sampling technique was non probability convenient sampling and the sample size was calculated by using the WHO software. Patients included in this study were of known cases of end stage renal disease. Patients excluded from the study were of ischemic heart and valvular heart disease. Linear Regression Analysis was conducted and R value was computed.

Results: R^2 value indicates 83% of the dependent variable of left ventricular mass can be explained by the independent variables of Systolic Blood Pressure and Diastolic Blood Pressure. Scatter plot between creatinine and hemoglobin showed negative correlation. A rise in serum level of creatinine showed a decreased serum level of hemoglobin. Scatter plot between left ventricular hypertrophy and creatinine showed positive correlation. An increase in left ventricular mass showed an increase serum creatinine level.

Study Limitation: Few biochemical parameters were conducted.

Conclusion: Left Ventricular Hypertrophy is frequent in End Stage Renal Disease.

Key words: Left Ventricular Hypertrophy **(**LVH), End Stage Renal Disease (ESRD), anemia, renal function, creatinine.

Introduction

Chronic renal failure is a devastating medical, social, and economic problem for patients and their families in Pakistan. Reliable data on the true incidence and prevalence of end-stage renal disease (ESRD) in Pakistan is lacking because no national registries exist, however Jafar et al showed the overall estimated prevalence of chronic kidney disease (CKD) in Pakistan is 29.9%.[1] The prevalence of CKD is even higher among patients with cardiovascular disease.[2] Cardiovascular disease is the leading cause of morbidity and mortality contributing for more than 40% of hospital admissions and 50% deaths.[3] The frequency of death attributed to CVD is 10-20 times greater than in the general population.[4] Kazmi et al also found several factors like diabetes (40%) and hypertension (31%) which were associated with the morbidity and mortality of patients with ESRD.[5] The control of these risk factors is necessary which can lead to cardiac morbidity leading to high mortality. According to Anees et al most of the patients in different stages of CKD had higher degree of cardiovascular co-morbidity leading to increased mortality.[6] Nardi et al found the prevalence of left ventricular hypertrophy and the geometric changes in left ventricle dimensions is 47% in different stages of CKD, he also showed that there were 52% patients with inappropriate left ventricular mass.[7] Paoletti et al studied CKD patients on maintenance hemodialysis and the risk factors related to the development of left ventricular hypertrophy were analyzed. In his study group he found 78% prevalence of LVH in patients who were being treated with haemodialysis.[8]

Rationale

Left Ventricular Hypertrophy (LVH) in ESRD patients on hemodialysis is associated with increased cardiovascular morbidity and mortality. The aim of this study was to determine the correlation between LVH and different risk factors so that there could be earlier detection to decrease morbidity and mortality related to LVH in ESRD patients on hemodialysis. The objective of the study was to determine prevalence of LVH in ESRD patients on chronic hemodialysis.

Materials and methods

Study design and study cases

This cross sectional study was conducted at the Department of Nephrology, Kulsom Bi Valika Social Security Site Hospital, Karachi and the sampling technique was non-probability

convenient sampling. The duration of the study was from March 2012 till February 2013. Sample size was calculated by using the WHO software edited by Lwanga and Lemeshaw, where alpha = 5%, power of the test (1-Beta) = 90, test value of population proportion, Po=0.75%, anticipated value of population proportion, Pa=0.55%, sample size will be n = 46. Patients included in this study were of 18 years and above of either gender, patients with known cases of end stage renal disease, haemodialysis for at least 6 months duration, diabetes mellitus and hypertension. Patients excluded from the study were bed bound patients, with terminal illness, patients on mechanical ventilator support, ischemic heart disease, valvular heart disease, congenital heart disease and liver disease.

Data Collection Procedure

This study was conducted after taking the approval from the ethical review committee of the institute. Participants were selected from out-patients Department of Nephrology, Kulsom Bi Valika Social Security Site Hospital. Eligible participants were enrolled in the study after taking informed consent. 5 ml of blood was collected for analysis. Echocardiography was performed on Toshiba ultrasound machine, 2-dimention echocardiography was performed by single person to minimize the bias in findings due to person to person variability. According to national kidney foundation guidelines in CKD anemia is considered

1. Hemoglobin level <13.5 g/dL in adult males.

2. Hemoglobin level <12.0 g/dL in adult females.[9]

Glomerular filtration rate (GFR) was calculated from National Kidney Disease Education Program (NKDEP) GFR Modification of Diet in Renal Disease (MDRD) calculator for adults.[10] Left ventricular mass (LVM) and Left ventricular mass index (LVMI) were calculated according to the Canadian Society of Echocardiography online software. Reference values of normal LVMI according to body surface area in gm/m^2 was (43-95 in F=females and 49-115 in M=males), while mild abnormal (96-108 in F, 116-131 in M), moderately abnormal (109-121 in F, 132-148 in M), severely abnormal (≥122 in F, ≥149 in M).[11]

Data Analysis

The data was entered on Statistical Package for Social Sciences (SPSS) version 20 (SPSS, Inc., Chicago, IL, USA) and analyzed. Continuous variables like age and GFR (ml/min), blood sugar fasting/random (mg/dl), systolic/diastolic blood pressure (mm Hg), BMI (kg/m^2), LVM (gram), LVMI (gm/m2), hemoglobin (gm/dl) was expressed as mean ± SD. Frequency and percentage were calculated for categorical variables like gender, hypertension, diabetes, anemia. In this study dependent variable was left ventricular mass and left ventricular mass index, while independent variables were age, gender, duration of ESRD (in months), GFR (ml/min), hemoglobin (gm/dl), diabetes (yes/no), hypertension (yes/no), anemia (yes/no). Logistic

regression analysis was performed to determine the association of other factors on the dependent variable of left ventricular mass.

Results

Descriptive statistics were computed. (Table 1) The prevalence of LVH based on raised LVMI was 66.7% while 33.3% did not had LVH. Linear Regression Analysis model summary provides R and R^2 values. The R value is 0.67 for systolic blood pressure, 0.91 for systolic and diastolic blood pressure. The R^2 value indicates how much of the dependent variable of left ventricular mass can be explained by the independent variable. In this case, 44% can be explained by systolic blood pressure and 83% can be explained by combined effect (systolic and diastolic blood pressure). (Table 2) ANOVA table indicates that the regression model predicts the outcome variable significantly well. The Regression row shows the Sig. column (*p*-value), this indicates the statistical significance that was applied. As, $p<0.05$, this indicates that overall model applied can statistically significantly predict the outcome variable of left ventricular mass. (Table 3) Scatter plot indicates serum creatinine as the explanatory variable, and hemoglobin as the response variable. Serum creatinine and hemoglobin levels were strongly negatively correlated, R Sq Linear

= -0.62. As the serum level of creatinine increases serum hemoglobin level decreases. (Figure 1) Scatter plot indicates left ventricular hypertrophy as the explanatory variable, and creatinine as the response variable. Left ventricular hypertrophy and creatinine level were strongly positively correlated, R Sq Linear = 0.739. As the left ventricular mass increases serum creatinine level also increases. (Figure 2)

Study Limitation

Although the research has reached its aims, there were some limitations that need to be mentioned. Further studies should be conducted to observe the causal association of left ventricular hypertrophy in end stage renal disease. Detailed biochemical studies should be conducted to study this association.

Ethical Considerations

The study protocol was approved by ethical review committee. Written informed consent was taken from the participants before their enrolment in this study. The participants' involvement in this study was voluntary and no financial incentives were provided to any study participant.

Discussion

In the present study the mean age of the participants was 50 ± 7.34 years among them 75% were males and 25% were females, all patients were anemic with mean Hb of 7.50±0.50 gm/dl.

Majority (75%) were hypertensive and the prevalence of LVMI was found to be 66.7%. It is well known fact that the prevalence of CKD is higher among patients with cardiovascular disease as it was observed by many studies and also in a large scale study conducted by Rizvi.[2] According to United States Renal Data System (USRDS) 2003 annual data report cardiovascular disease was the leading cause of morbidity and mortality among all the patients which contributed for more than 40% of admissions to the hospital and 50% of deaths.[3] The frequency of death attributed to cardiovascular disease is 10-20 times than in the general population.[4] It is well known that end stage renal disease patients are at highest risk of mortality due to cardiovascular disease as was observed by Foley, in his study on epidemiology of CVD in chronic renal disease.[15] In this study mean age of patients was 50 years. All patients showed anemia with mean Hb level 7.5±05 gm/dl which is a conspicuous characteristic, although anemia is present in almost all of the patients the high prevalence of left ventricular hypertrophy in hemodialysis patients is similar to other studies which showed prevalence of 89.7% in a study conducted by Yilmaz et al[15] and 75.9% prevalence in a study conducted by Kutlay.[16] Poletti et al found 74% prevalence of left ventricular hypertrophy and 66% prevalence of hypertension. This finding is similar in our population as 75% of patients were found to be hypertensive. Stojimirovics showed that although anemia was present in most of the patients of CKD who are also having cardiovascular disease and they established an evidence that anemia is an independent risk factor for development of left ventricular hypertrophy but they also showed, control of these risk factors can lead to regression of left ventricular hypertrophy.[17] In this study we observed similar findings of left ventricular hypertrophy and anemia as a risk factor. Coronary disease and left ventricular hypertrophy in patients with End Stage Chronic Kidney Disease (ESCKD) have been recognized as atypical presentations of heart disease.[18] The present study corroborates these findings as approximately 40% of the patients with LVH have stage-3 CKD. Guidelines about CVD in patients with CKD are based on opinions, not on evidence, showing the lack of information in this area.[18] The first step to reverse is identifying and quantifying the magnitude of the problem. The challenge faced by physicians is to identify CKD and treat it aggressively.

Conclusion and Recommendations

The results conclude that left ventricular hypertrophy is associated with end stage renal disease. Factors which can be helpful in regression of left ventricular hypertrophy in our population should be studied. Emphasis should be given to control hypertension and to achieve optimal correction of anemia so the related morbidity and the high mortality can be declined.

Conflict of Interest: The authors declare that they have no competing interests.

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Table 1: Descriptive Statistics

Demographic profile and Serum Parameters	
Characteristics	Mean ± SD or %
Age (years)	50 ± 7.34
Gender	Males (75%)
LVH	66.7%
Weight (Kg)	61±5.2
Height (inches)	62.5±2.08
Hb (gm/dl)	7.50±0.50
Calcium (mg/dl)	7.47±1.4
Phosphorus (mg/dl)	5.27±2.17
Albumin (g/dl)	3.07±0.16
Urea (mg/dl)	1.34±5.2
Creatinine (mg/dl)	4.1±1.32
Anemia (yes/no)	100%
Smoker (yes/no)	25%
Hypertension (yes/no)	75%
Ejection Fraction (%)	46.25±1.72

Table 2: Model Summary [d]

Model	R	R Square	Adjusted R Square
1	0.670[a]	0.448	0.436
2	0.914[b]	0.836	0.828
3	1.000[c]	1.000	1.000

a. Predictors: (Constant), S. BP
b. Predictors: (Constant), S. BP, D. BP
c. Predictors: (Constant), S. BP, D. BP, Hb
d. Dependent Variable: Left Ventricular Mass

Table 3: ANOVA [d]

Model		Df	F	Sig.
1.	Regression	1	37.370	0.0001[a]
2.	Regression	2	114.301	0.0001[b]
3.	Regression	3		0.0001[c]

a. Predictors: (Constant), S. BP
b. Predictors: (Constant), S. BP, D. BP
c. Predictors: (Constant), S. BP, D. BP, Hb
d. Dependent Variable: Left Ventricular Mass

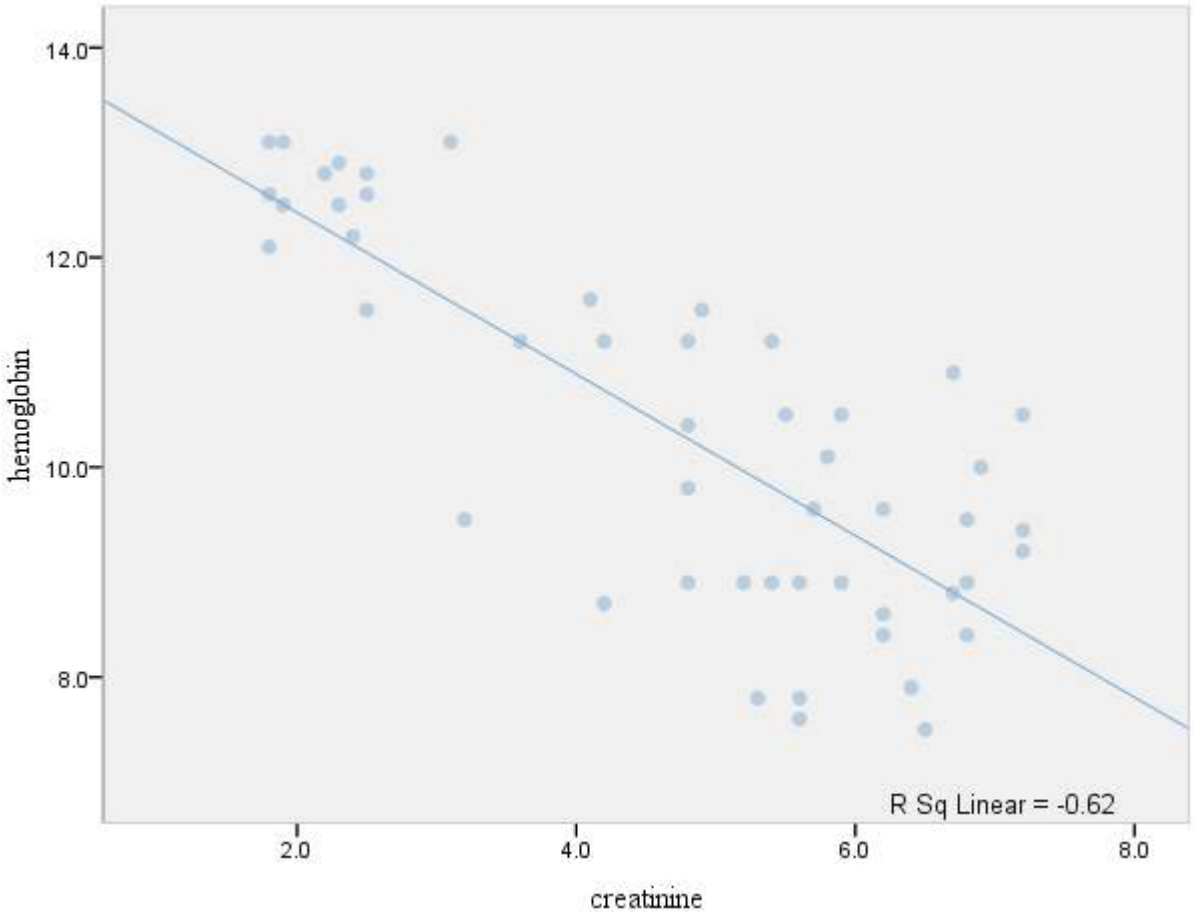

Figure 1: Negative correlation of serum creatinine versus hemoglobin

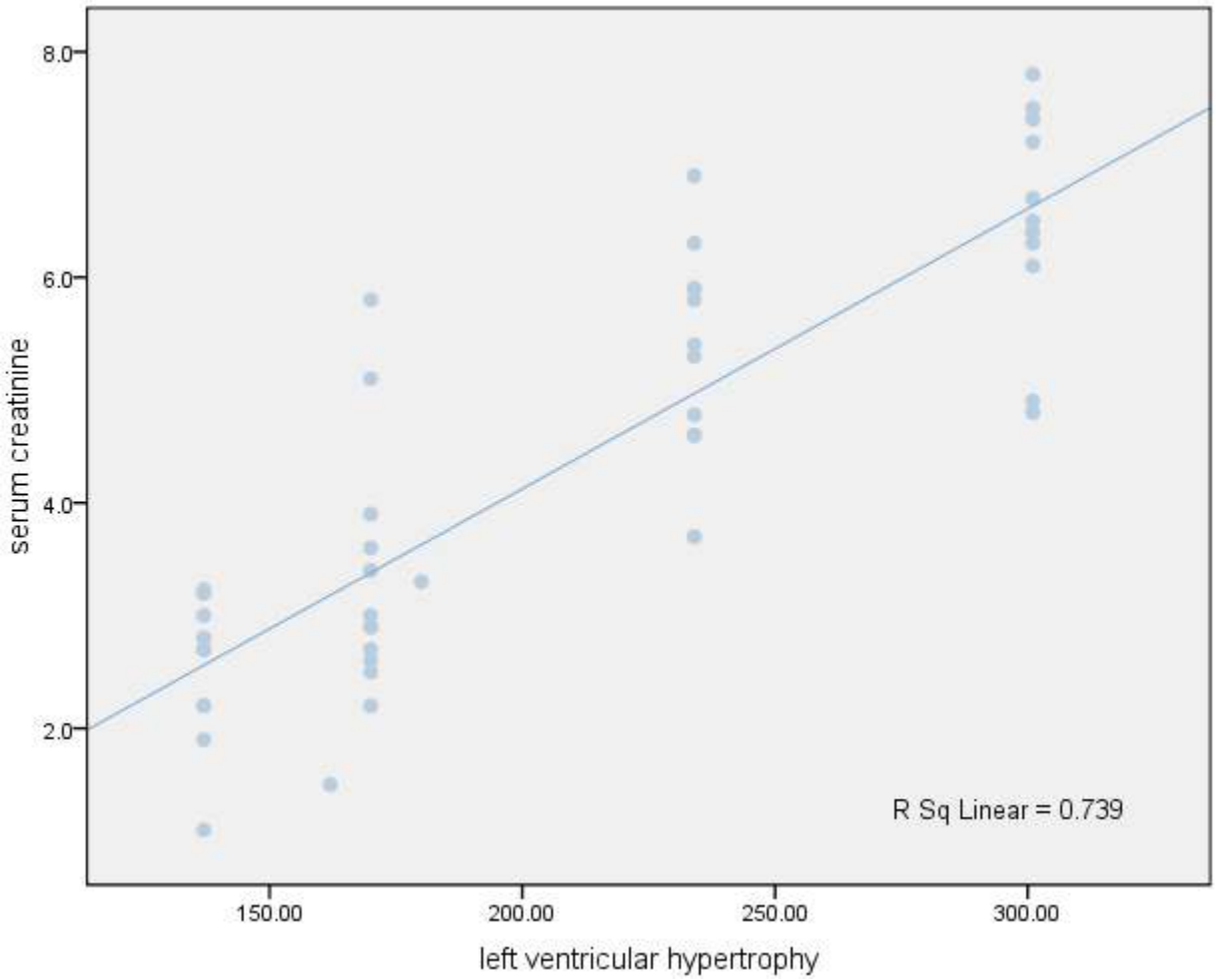

Figure 2: Positive correlation of left ventricular hypertrophy versus serum creatinine