Effect of Hemodialysis Duration on Left Ventricular Hypertrophy in Patients of Chronic Kidney Disease

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ABSTRACT

Objective: To ascertain the effect of duration of hemodialysis on left ventricular hypertrophy in patients with chronic kidney disease.

Design: It was a cross sectional observational study.

Study Settings: Department of Cardiology, Shaikh Zayed Hospital Lahore over a period of 6 months from January 2021 to June 2021.

Material and Methods: This study was conducted, between February and September 2021, by recruiting 200 patients undergoing hemodialysis. Demographic and clinical data were recorded. Blood samples were taken for investigation. Body surface area was calculated using Du Bois Formula. To calculate LVM, Echocardiography (Echo) was done by using 2D M-mode in the standard manner. At the end of data collection, data was entered and analyzed using SPSS v.21. Single and multiple linear regression analysis were used to calculate impact of duration and other confounding variable on LVM.

Results: The mean age of the participant was 46.7±13.263. About 58.5% (117) were males and 41.5% (83) were females. Prevalence of LVH was 171(85.5%). The mean LVM for males and females was 248.44±26.67g and 182.88±22.43g respectively. Most of the participants (47.0%) were receiving HD for 25-36 months followed by 26.0%, 15.0%, 12.0% for 13-24 months, 3-12 months,37-48 months respectively. LVH was found to be strongly positively correlated with duration of dialysis. Increasing duration of HD was associated with an increased likelihood of exhibiting LVH.

Conclusion: The study concluded that there exist significantly strong relationship between increased duration of hemodialysis in CKD patients with frequency of left ventricular hypertrophy. So, in future practice it is recommended to focus on CKD patients undergoing hemodialysis with regard to duration of hemodialysis and expected frequency of left ventricular hypertrophy and its timely management.

Keywords: Chronic kidney disease, Left ventricular hypertrophy, Left ventricular mass index, Haemodialysis.

INTRODUCTION

Heart failure (HF) is the leading cause of cardiovascular disease in patients with chronic kidney disease (CKD). As a result, in CKD patients, HF prediction and prevention are critical. Left ventricular hypertrophy (LVH) is the most common cause of HF. Thus, in CKD, HF early identification and mitigation are highly important. Due to increased preload, afterload, or both in patients of CKD, LV starts to develop hypertrophy by the adaptive mechanism. It has been noted that when both are present in one patient this process increases several times. LVH is explained as an abnormal increase in LV mass (LVM) determined by echocardiography (Echo) in patients with CKD. There is now steady evidence that LVH has a significant prognostic importance in CKD patients. LVH starts during the initial phases of CKD and impacts up to 20% of people in the first three stages of the disease. Left ventricular mass grows as CKD progresses, and LVH may effect up to 80% of ESRD patients during the onset of haemodialysis therapy. In patients with CKD, cardiovascular disorders including coronary artery disease, congestive heart failure, arrhythmias, and sudden cardiac death are prominent causes of illness and mortality.

In response to pathophysiological stressors, the left ventricular mass (LVM) arises causing LVH. Concentric LVH is caused by pressure overload as well as hypertension (HTN), while eccentric LVH is caused by volume overload as well as valvular disease. The presence of LVH is linked with an elevated risk of cardiovascular events and mortality, while the absence of LVH is linked to a decrease in cardiovascular (CVS) disease and mortality. Patients with CKD are more likely to suffer from an acute cardiac event. In these patients, LVH is a prevalent condition that results in considerable morbidity and mortality.

The term "cardiorenal syndrome" was introduced at a consensus conference of the Acute Dialysis Quality Initiative Group to describe a clinical overlap between cardiac and renal problems. The primary hallmark of uremic cardiopathy is LVH, which is linked to CRS type 4 (chronic cardio renal syndrome). Regardless of glomerular filtration rate (GFR) levels, CVS problems can occur at any time in CKD patients. More frequent HD has been proposed as a novel therapeutic paradigm, and observational studies have linked longer and more frequent HD sessions to a reduced prevalence of LVH. Foley et al. reported that the probability of developing LVH increased with increased duration of HD and there was a strong correlation between LVM and duration of dialysis. But the evidence was limited to a fewer international studies and there was no locally published material that's why this study was conducted in local settings which are different from foreign settings and associated health care facilities to establish this relationship.

MATERIAL AND METHODS

A total of 200 patients with CKD having age above 18 years undergoing hemodialysis were selected from the Nephrology department, SKZ Hospital Lahore. Patients with acute or chronic infection, autoimmune disease, valvular pathology and other congenital heart diseases, diagnosed cardiovascular disease before starting haemodialysis treatment or with poor echogenic window or receiving active treatment with steroids or immunosuppresses and malignancy were excluded from the study. A detailed explanation of the purpose of the study, potential risks, and benefits were given. After that patients were asked to sign a consent form. Demographic and previous clinical data were collected from the patients' medical records which included: age, gender, BMI, blood sugar levels, and aetiology of CKD. SBP and DBP were taken on the spot. Blood samples were collected from all patients for blood tests after 12-hour overnight fasting. The eGFR was calculated by using the Cockcroft and Gault formula.

All patients underwent baseline laboratory investigations including Hb levels, serum creatinine, serum urea, and baseline ECG. All lab investigations were done by the pathology department of SKZ hospital. 2D M-mode Echo and Doppler examinations were
performed in the standard manner. The M-mode examination was carried out in accordance with the recommendations of the American Society of echocardiography. Echocardiography was used to measure the left ventricular end-diastolic diameter (LVEDD), left ventricular end-systolic diameter (LVESD), inter-ventricular septum thickness (IVST), left ventricular posterior wall thickness (LVPWT), left atrial diameter (LAD), RWMA and EF. Data was entered and analysed by using SPSS v.21. Data were analyzed by a statistician blinded to the patients and groups. Data for age, duration of dialysis, LVMI, creatinine, haemoglobin, BMI, urea, SBP, DBP and albuminuria were addressed to a lower goal haemoglobin level (12 g/dl). This finding is similar to other studies from Iraq (69% males and 31% females) by Latif et al., KSA (60.1% males and 39.9% females) by Shaheen and Al-Khader et al., and India (67.8% males and 32.2% females) by Kartheek and Reddy, who had previously studied similar male predominance in patients with CKD undergoing hemodialysis. Mean BMI in this study was 26.32±2.18 years. A little lower BMI in patients with CKD was reported by Han et al. as 25.05±4.12 years. For CKD patients, anaemia is a serious issue as well as a predictor of CVS risk. The average haemoglobin concentration in those patients who had severe anaemia at onset (10 g/dl) and were addressed to a lower goal haemoglobin level (12 g/dl).

Most of the participants in the study were middle-aged with a mean age of 46.77±13.263 years. The mean age of patients in the study was lower than USA and Kingdom of Saudi Arabia which reported similar male predominance in patients with CKD.

The study used echocardiography which is an excellent non-invasive diagnostic modality and found that prevalence of LVH was 171(85.5%). This finding is similar to other studies from Iraq (69% males and 31% females) by Latif et al., KSA (60.1% males and 39.9% females) by Shaheen and Al-Khader et al., and India (67.8% males and 32.2% females) by Kartheek and Reddy, who had previously reported similar male predominance in patients with CKD undergoing hemodialysis.

A noteworthy gender difference was noted in this study in relation with distribution of disease as 58.5% (117) were males and 41.5% (83) were females. The mean haemoglobin level was 8.81g/dl. The prevalence of LVH was 171(85.5%). A total of 33.5% (67) patients were suffering from DM along with CKD. About 126 patients were suffering from HTN. Out of all the patients, 29 males and 16 females were concurrently suffering from both DM and HTN. Most patients (88%) were receiving dialysis for 5 times per week followed by 9% two times per week and only 3% once a week. The mean duration of dialysis onset was 25.31±9.85 months. Most of the participants (47.0%) were receiving HD for 25-36 months followed by 26.0%, 15.0%, 12.0% for 13-24 months, 3-12 months, and 37-48 months respectively as given in Table 1.

### RESULTS
A total of 200 participants were involved in the study. The mean age of the participants was 46.77±13.263. The mean BMI was 26.32±2.18g/m2. Out of 200 hundred HD patients, 58.5% (117) were males and 41.5% (83) were females. The mean haemoglobin level was 8.81g/dl. The prevalence of LVH was 171(85.5%). A total of 33.5% (67) patients were suffering from DM along with CKD. About 126 patients were suffering from HTN. Out of all the patients, 29 males and 16 females were concurrently suffering from both DM and HTN. Most patients (88%) were receiving dialysis for 5 times per week followed by 9% two times per week and only 3% once a week. The mean duration of dialysis onset was 25.31±9.85 months. Most of the participants (47.0%) were receiving HD for 25-36 months followed by 26.0%, 15.0%, 12.0% for 13-24 months, 3-12 months, and 37-48 months respectively as given in Table 1.

### DISCUSSION
LVH is a common cause of morbidity in people with CKD, and it puts them at risk for heart failure. Multiple risk variables play role including volume overload, inflammation, anaemia, hypo-albuminaemia, hyperphosphataemia and arterial HTN, etc. This study was conducted to determine effect of hemodialysis duration on left ventricle hypertrophy in patients with CKD.

Most of the participants in the study were middle-aged with a mean age of 46.77±13.263 years. The mean age of patients in this study was lower than USA and Kingdom of Saudi Arabia which was discovered to be 60 years old and 55 years old, respectively by Han et al. and Rizvi and Manzoor as 47.4 years in the range of 17-85 years.

### Table 3: Relationship between LVH and duration of HD

<table>
<thead>
<tr>
<th>Directional Measures</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal by Interval</td>
<td></td>
</tr>
<tr>
<td>Eta</td>
<td></td>
</tr>
<tr>
<td>Presence of Left Ventricular Hypertrophy Dependent</td>
<td>966</td>
</tr>
<tr>
<td>Duration since in dialysis(months) Dependent</td>
<td>158</td>
</tr>
<tr>
<td>Correlations</td>
<td></td>
</tr>
<tr>
<td>Presence of LVH</td>
<td></td>
</tr>
<tr>
<td>Pearson Correlation</td>
<td></td>
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<tr>
<td>Sig. (2-tailed)</td>
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<tr>
<td>Presence of LVH</td>
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<tr>
<td>Pearson Correlation</td>
<td></td>
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<tr>
<td>Sig. (2-tailed)</td>
<td></td>
</tr>
<tr>
<td>Duration of dialysis (months)</td>
<td></td>
</tr>
</tbody>
</table>

### Table 4: Relation between LVH and HTN

<table>
<thead>
<tr>
<th>Chi-Square Tests</th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>2.79</td>
<td>1</td>
<td>.0497</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>276</td>
<td>1</td>
<td>.600</td>
</tr>
</tbody>
</table>

The study used echocardiography which is an excellent non-invasive diagnostic modality and found that prevalence of LVH was 171(85.5%). This prevalence is relatively high as compared to other studies such as 65% in Iraq and 46% in Denmark but was similar to HEMO studies which have clearly demonstrated that the prevalence of LVH is more than 80% in HD patients.
Toxins are unknown, some components in uremic plasma have been identified as having potential inotropic and chronotropic effects. Dialysis for a prolonged period of time exposes myocytes to uremic toxins for a prolonged period of time. This could help to explain why LVH is so common.\(^8\) Individuals with large body sizes may have larger LVMs. As a result, indexing LVMs has been recommended as a way to improve LVM calculation by reducing the effect of body size.\(^9\) Mean LVM for males and females was 248.4±25.67 and 192.88 respectively. When prevalence was compared among both genders; males had a significantly higher prevalence with a ratio of 1.65:1 for male to female; which is similar to previous studies.\(^10,11\)

Most patients (88%) were receiving dialysis 3 times per week followed by 9% two times per week and only 3% once a week. The mean duration of dialysis onset was 25.3±9.85 months. Nominal by Interval Eta correlation between LVH and duration showed that LVH in this study is strongly positively correlated with the duration with Eta=0.966 and R2= 0.025. Better control of hemodialysis sessions and peritoneal dialysis exchanges is a significant element in the care of LVH patients. More frequent HD has been proposed as a novel therapeutic paradigm, and observational studies have linked longer and more frequent HD sessions to a reduced prevalence of LVH.\(^12\) As there was no follow-up and intervention in this study this recommendation was not studied.

To determine impact of HD duration onset on likelihood of patients having LVH, logistic regression was used. The logistic regression model successfully identified 85.5% of patients and explained 4.3% of the variance in heart disease and our findings are in line with earlier reported relationship by Foley et al.\(^13\)

Finally, there are certain limitations to this research. First and foremost, this is a cross-sectional study, with all the limitations that entail. It is necessary to be speculative while discussing potential causal pathways. One of the study’s shortcomings is that it was designed to exclude participants with obvious pre-existing heart illnesses. To rule out asymptomatic coronary ischemia, no stress tests were conducted. It was impossible to track changes in heart morphology over time as a result of the removal of excess fluid by renal replacement therapy. As a result, in the observational investigation, the association between fluid overload and LVH does not allow us to assess causality. Furthermore, while urine volume and proteinuria were variables that may influence our findings, we were unable to analyze them since they were not accurately measured in all individuals. Another drawback was being a single centered this study has a high probability of patient selection bias. This study, on the other hand, offers some advantages. The study’s key strength was that the patients were very similar health condition and the majority of them had three sessions each week.

CONCLUSION

This study concludes that as the duration of dialysis increases frequency of LVH. Therefore, in future practice, it is recommended to consider the same to cope with its shortcomings and associated side effects.

REFERENCES