DOI: https://doi.org/10.54393/pjhs.v4i03.641

PAKISTAN JOURNAL OF HEALTH SCIENCES
https://thejas.com.pk/index.php/pjhs
Volume 4, Issue 3 (March 2023)

Original Article

Prevalence of Left Ventricular Hypertrophy in End Stage Renal Disease Patients on Maintenance Hemodialysis

Afreen Naz[1], Bhagwan Das[2*], Sughand Memon[3], Sanjay[2], Rafia Memon[4] and Kishor Kumar[4]

[1]Trauma Center, Hyderabad, Pakistan
[2]Department of Nephrology, Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan
[3]Ziauddin University Hospital, Karachi, Pakistan
[4]Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan

ARTICLE INFO

Key Words:
Left Ventricular Hypertrophy, End Stage Renal Disease, Maintenance Hemodialysis

How to Cite:
Naz, A. ., Das, B. ., Memon, S. ., Sanjay, ., Memon, R. ., & Kumar, K. . (2023). Prevalence of Left Ventricular Hypertrophy in End Stage Renal Disease Patients on Maintenance Hemodialysis : Ventricular Hypertrophy in End Stage Renal Disease. Pakistan Journal of Health Sciences, 4(03). https://doi.org/10.54393/pjhs.v4i03.641

Corresponding Author:
Bhagwan Das
Department of Nephrology, Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan
dr_jairamani@hotmail.com

Received Date: 14th March, 2023
Acceptance Date: 28th March, 2023
Published Date: 31st March, 2023

ABSTRACT

Among the hemodialysis population, left ventricular hypertrophy (LVH) is becoming a major cause of cardiovascular death, mainly due to myocardial infarction, heart failure, and arrhythmias. **Objective:** To determine the frequency of left ventricular hypertrophy in ESRD patients on maintenance hemodialysis. **Methods:** The Descriptive Cross-sectional study was conducted at Department of Nephrology, Liaquat University of Medical and Health Sciences Jamshoro. All patients above 18 years of age and below 65 years of age of both gender having end stage renal disease on maintenance hemodialysis with 3 months or more of maintenance hemodialysis were consecutively enrolled. On dialysis free day patients meeting inclusion criteria was sent for Trans Thoracic Echocardiography. Measurements was taken as inter-ventricular septal thickness, left ventricular end-diastolic diameter and left ventricular posterior wall thickness through parasternal long axis or short axis just distal to the tip of mitral valve leaflet. **Results:** The mean age of the patients was 53.54 ± 11.63 years. There were 72 (61.5%) males and 45 (38.5%) females. The mean duration of hemodialysis was 5.61 ± 0.97 months. The mean duration of ESRD was 7.23 ± 0.78 months. Type 2 diabetes mellitus was found in 73 (62.4%) and hypertension in 71 (60.7%) patients. The frequency of left ventricular hypertrophy was found in 53 (45.3%) patients. **Conclusions:** The frequency of left ventricular hypertrophy was found to be 45.3% in ESRD patients on maintenance hemodialysis.

INTRODUCTION

Presence of structural, functional loss of kidneys and/or glomerular filtration rate (eGfr) less than 60 ml/min/1.73m2 for at least three months is known as chronic kidney disease [1, 2]. In Pakistan, prevalence of CKD is 12.5 to 16.6% [3]. It has five stages, patients with stage 5 of chronic kidney disease also known as end-stage renal disease requires renal replacement therapy, of which hemodialysis is the most widely used RRT all over the world [4]. In patients with ESRD, there are various changes in the structure of heart and its functions, these changes lead to increased morbidity and mortality from cardiovascular disease especially ischemic heart disease and cardiac failure [5]. Cardiovascular disease is more prevalent in patients who are suffering from chronic renal impairment than in the general population [6]. The risk of sudden cardiac death in these patients is four to 20 times higher as compared to the general population [7]. Apart from cardiovascular disease patients of regular hemodialysis are at increased risk of sudden cardiac death due to inflammatory state and hemodynamic overload of dialysis, these causes ischemia of myocardium during hemodialysis, decreased PR interval in the electrocardiogram, increased prevalence of ventricular repolarization changes, prolonged QT interval, and

DOI: https://doi.org/10.54393/pjhs.v4i03.641

increased vulnerability of ventricular arrhythmias [8]. Left ventricular hypertrophy has been described as a more frequently occurred cardiovascular complication in ESRD patients on hemodialysis with prevalence of 70%, its presence in this patient population indicates poor outcome because it can be associated with the development of heart failure, ischemic heart disease, arrhythmias and sudden death [9, 10]. LVH occurs in concentric and eccentric patterns [11]. In patients with impaired renal function, these changes occur due to pressure and fluid overload [12]. Raised blood pressure, hypervolemia, anemia, chronic kidney disease, mineral and bone disorder (CKD-MBD), oxidative stress, and inflammatory state have been involved in causing left ventricular hypertrophy [13]. In hemodialysis patients' regression of LVH has been shown after successful kidney transplantation [14]. In patients with chronic kidney disease abnormal cardiac function or structure of the heart can be identified by using echocardiography [15]. Left ventricular hypertrophy is a risk factor for cardiac morbidity, mortality in patients on hemodialysis. Early detection and regression of left ventricular hypertrophy can cause reduction in cardiovascular mortality in uremic patients. Hence this study was conducted with the aim to determine the frequency of left ventricular hypertrophy in ESRD patients on maintenance hemodialysis.

METHODS

The Descriptive Cross-sectional study was conducted at Department of Nephrology, Liaquat University of Medical and Health Sciences Jamshoro. 100 patients above 18 years of age and below 65 years of age of both gender having end stage renal disease on maintenance hemodialysis with 3 months or more of maintenance hemodialysis were enrolled via nonprobability consecutive sampling methods. Sample size was calculated via Openepi sample size calculator by taking prevalence of left ventricular hypertrophy in ESRD patients as 6.8% [9]. Patients with congenital heart diseases, poor transthoracic echo-images, with chest deformities and chronic obstructive airway disease were excluded from the study. Patients on maintenance hemodialysis meeting the inclusion criteria was selected for the study. Brief history, with special reference to duration of ESRD and hemodialysis, history of comorbid like T2DM, hypertension (on treatment verified by Physicians prescription) was taken. Heights was measured on stadiometer without shoes and cap in cm and later convert in meters. Weight was measured bathroom scale rounded 0.1 kg without shoes and in light clothes. On dialysis free day patients meeting inclusion criteria was sent for Trans Thoracic Echocardiography by a trained cardiologist. Echocardiography with a 3.3 MHz multiphase array probe was used to obtain two dimensional (2D) echocardiograms in subjects lying in the left decubitus position. Measurements was taken as inter- ventricular septal thickness, left ventricular end-diastolic diameter and left ventricular posterior wall thickness through parasternal long axis or short axis just distal to the tip of mitral valve leaflet. All the information obtained from patients was recorded on the predesigned Proforma". The study lasted 6 months from Oct 2020 to March 2021. The data were analyzed via SPSS version 21.0. Quantitative variables i.e., age, height, weight, BMI, duration of hemodialysis was recorded as Mean ± Standard Deviation (SD). Frequency and percentages were computed for qualitative variables like Gender and Echocardiographic Findings (Left Ventricular Hypertrophy). Effect modifiers like gender, age, BMI, duration of hemodialysis and ESRD and comorbid like T2DM vs H/o HTN was controlled through stratification. Post stratification Chi Square Test was applied, keeping p-value 0.05 as significant.

RESULTS

The mean age of "the patients was 53.54 ± 11.63 years. Majority of the patients (n=72, 61.5%) were presented with >55 years of age. There were 72 (61.5%) males and 45 (38.5%) females (38.5%).

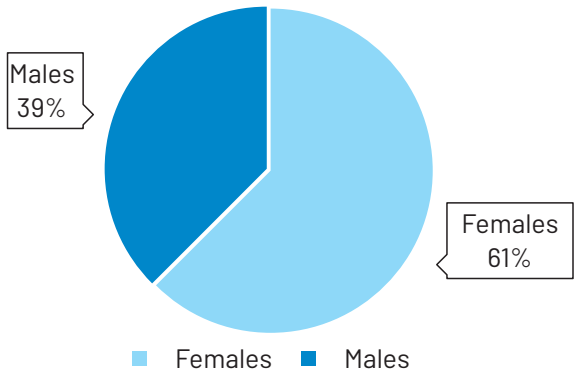

Figure 1: Gender distribution of patients (N=117)

The mean weight, height, and BMI of the patients was 60.05 ± 5.09 kg, 1.53 ± 0.05 m, and 27.67 ± 4.76 kg/m^2 respectively (Table No. 1). Most of the patients had ≤ 30 kg/m^2 of BMI. The mean duration of hemodialysis was 5.61 ±0.97 months (Table 1). Most of the patients (n=84, 71.8%) were presented with >5 months of duration of hemodialysis. The mean duration of ESRD was 7.23 ± 0.78 months (Table 1).

Table 1: Sample description (N=117)

Variable	MEAN ± SD	Minimum	Maximum
Mean Age	53.54 ± 11.63 Years	18	65
Mean Weight	60.05 ± 5.09 Kg	53	66
Mean Height	1.53 ± 0.05 m	1.5	1.63
Mean BMI	27.67 ± 4.76 Kg/m2	18.70	33.0
Mean Duration of Hemodialysis	5.61 ± 0.97 Years	4	7
Mean Duration of ESRD	7.23 ± 0.78 Months	6	8

DOI: https://doi.org/10.54393/pjhs.v4i03.641

Most of the patients (n=65, 55.6%) were presented with >5 months of duration of hemodialysis. Type 2 diabetes mellitus was found in 73 (62.4%) and hypertension in 71 (60.7%) patients. The frequency of left ventricular hypertrophy was found in 53 (45.3%) patients. A significantly higher association of left ventricular hypertrophy was observed with hypertension (p-value 0.009) while other variables were found to be insignificant (Table 2).

Table 2: Comparison of left ventricular hypertrophy among patients(N=117)

Variable	Left ventricular Hypertrophy		Total	p-value
	Yes	No		
Age of patients				
≤55	20 (44.4)	25 (55.6)	45 (100)	0.883
>55	33 (45.8)	39 (54.2)	72 (100)	
Total	53 (45.3)	64 (54.7)	117 (100)	
Gender of patients				
Male	23 (37.1)	39 (62.9)	62 (100)	0.058
Female	30 (54.5)	25 (45.5)	55 (100)	
Total	53 (45.3)	64 (54.7)	117 (100)	
Diabetes mellitus				
Yes	32 (43.8)	41 (56.2)	73 (100)	0.682
No	21 (47.7)	23 (52.3)	44 (100)	
Total	53 (45.3)	64 (54.7)	117 (100)	
Hypertension				
Yes	39 (54.9)	32 (45.1)	71 (100)	0.009
No	14 (30.4)	32 (69.6)	46 (100)	
Total	53 (45.3)	64 (54.7)	117 (100)	

DISCUSSION

Cardiovascular disease is the most common cause of death in patients with ESRD and accounts for most of the morbidity in these population [16, 17]. Dialysis patients are subject to atherosclerosis eventually leading to ischemic heart disease and myocardial dysfunction causing heart failure all which are highly prevalent. Eighty-four percent of patients at initiation of ESRD therapy have LVH, left ventricular (LV) dilatation, or low fractional shortening, and LVH has been found in 38% of patients with chronic renal failure (CRF) prior to the requirement for dialysis [18]. In our study, the frequency of left ventricular hypertrophy was found in 53 (45.3%) patients. In another study, LVH has been described as a more frequently occurred cardiovascular complication in ESRD patients on hemodialysis with prevalence of 70%, its presence in this patient population indicates poor outcome because it can be associated with the development of heart failure, ischemic heart disease, arrhythmias and sudden death [9, 10]. LVH occurs in concentric and eccentric patterns [11]. In patients with impaired renal function, these changes occur due to pressure and fluid overload [12]. Raised blood pressure, hypervolemia, anemia, CKD-MBD, oxidative stress, and inflammatory state have been involved in causing left ventricular hypertrophy [13]. In hemodialysis patients' regression of LVH has been shown after successful kidney transplantation [14]. In patients with chronic kidney disease abnormal cardiac function or structure of the heart can be identified by using echocardiography [15]. The presence of LVH or LV dilatation (or both) is clearly a poor prognostic factor [19-21]. The current study was designed to determine LVH in ESRD patients on maintenance hemodialysis (MHD), due to the significant discrepancy in the percentage determined in previous studies and because no such study has been conducted in our targeted population. This result was more in agreement with results of Ifeoma and Tian, they determined it in 95.5% and 68.8% patients respectively, both which were over 50% and significantly high [22, 23]. The study by Kadir *et al.*, determined it in 46% and 46.42% patients respectively both which were less than 50% and considerably lower [24]. A significant association of LVH was found with hypertension. These findings are more in agreement with Kawamura *et al.*, study as they showed that 42.31% had hypertension [25]. However, anemia and diabetes mellitus were also considerably higher in their study which was not found in our study. These results signify that anemia was the most significant contributing risk factor leading to LVH in patients on MHD followed by hypertension and then diabetes mellitus. London noted that anemia is present in most patients initiating dialysis and that it could explain the high prevalence of LVH in these patients [26]. In a study by Ulasi *et al.*, a strong relationship was found between anemia and the prevalence of LVH in patients with chronic renal failure [27]. Anemia has been consistently associated with cardiovascular morbidity and LVH in the ESRD population and the results of this study are consistent with those in the literature [28]. Anemia leads to an increase in cardiac workload which subsequently leads to development of LVH. Several studies have been done to demonstrate if the reversal of anemia, using erythropoietin therapy, results in partial regression of LVH in the dialysis population with conflicting results [29].

CONCLUSIONS

The frequency of left ventricular hypertrophy was found to be 45.3% in ESRD patients on maintenance hemodialysis.

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The authors received no financial support for the research, authorship and/or publication of this article.

DOI: https://doi.org/10.54393/pjhs.v4i03.641

REFERENCES

[1] Meijers B, Farré R, Dejongh S, Vicario M, Evenepoel P. Intestinal barrier function in chronic kidney disease. Toxins. 2018 Jul; 10(7): 298. doi: 10.3390/toxins10070298.

[2] Anees M, Butt G, Gull S, Nazeer A, Hussain I, Ibrahim M. Factors Affecting Dermatological Manifestations in Patients with End Stage Renal Disease. Journal of the College of Physicians and Surgeons—pakistan: JCPSP. 2018 Feb; 28(2): 98-102. doi: 10.29271/jcpsp.2018.02.98.

[3] Shafi S, Saleem M, Anjum R, Abdullah W, Shafi T. ECG abnormalities in patients with chronic kidney disease. Journal of Ayub Medical College Abbottabad. 2017 Jan; 29(1): 61-4. doi: 10.4103/1319-2442.229270.

[4] Valentim B, Pereira A, Coelho P, Pereira T. Study of ventricular electrical systole in patients with end-stage kidney disease on hemodialysis. Arquivos Brasileiros de Cardiologia. 2013 Mar; 100: 261-8. doi: 10.5935/abc.20130063.

[5] OmraniH, Golshani S, Sharii V, Almasi A, Sadeghi M. The relationship between hemodialysis and the echocardiographic findings in patients with chronic kidney disease. Medical Archives. 2016 Oct; 70(5): 328-31. doi: 10.5455/medarh.2016.70.328-331.

[6] Gluba-Brzozka A, Franczyk B, Cialkowska-Rysz A, Olszewski R, Rysz J. Impact of vitamin d on the cardiovascular system in advanced chronic kidney disease (CKD) and dialysis patients. Nutrients. 2018 Jun; 10(6): 709. doi: 10.3390/nu10060709.

[7] Pun PH. The interplay between CKD, sudden cardiac death, and ventricular arrhythmias. Advances in Chronic Kidney Disease. 2014 Nov; 21(6): 480-8. doi: 10.1053/j.ackd.2014.06.007.

[8] BiqnottoLH, Kollas ME, Djouki RJ, Sassaki MM, Voss GO, Soto CL, *et al.* Electro cardiographic findings in chronic hemodialysis patients. Journal of Brazilian Nephrology. 2012 Jul; 34(3): 235-42. doi: 10.5935/0101-2800.20120004.

[9] AmoakoYA, Laryea DO, Bedu-Addo G, Nkum BC, Plange-Rhule J. Left ventricular hypertrophy among chronic kidney disease patients in Ghana. Pan African Medical Journal. 2017 Sep; 28: 79. doi: 10.11604/pamj.2017.28.79.9183.

[10] Kim SJ, Oh HJ, Yoo DE, Shin DH, Lee MJ, Kim HR. Electrocardiographic left ventricular hypertrophy and outcome in hemodialysis patients. Plos One. 2012; 7(4): e35534. doi: 10.1371/journal. pone. 0035534.

[11] Chen SC, Su HM, Hung CL, Chang JM, Liu WC, Tsai JC. Echocardiographic parameters are independently associated with rate of renal function decline and progression to dialysis in patients with chronic kidney disease. Clinical Journal of American Society of Nephrology. 2011 Dec; 6(12): 2750-8. doi: 10.2215/CJN.04660511.

[12] Wu Pr, Huang Jc, Chen Sc, Chen Ll. Type 2 diabetes mellitus- related changes in left ventricular structure and function in patients with chronic kidney disease. Oncotarget. 2018 Feb; 9(18): 14661-8. doi: 10.18632/oncotarget.24482.

[13] OqatoH, Kumasawa J, Fukuma S, Mizobuchi M, Kinuqasa E, Fukaqawa M. The cardiothoracic ratio and all- cause and cardiovascular disease mortality in patients undergoing maintenance hemodialysis: results of the MBD-5D study. Clinical and Experimental Nephrology. 2017 Oct; 21(5): 797-806. doi: 10.1007/s10157-017-1380-2.

[14] Dervisoglu E, Kazdag G, Etiler N, Kalender B. Association of glomerular filtration rate and inflammation with left ventricular hypertrophy in chronic kidney disease patients. Hippokratia. 2012 Apr; 16(2): 137-42.

[15] Mavrakanar TA, Khattak A, Singh K, Charytan DM. Echocardio graphic parameters and renal outcomes in patients with preserved renal function, and mild-moderate CKD. BMC Nephrology. 2018 Jul; 19(1): 176. doi: 10.1186/s12882-018-0975-5.

[16] Rahn KH, Barenbrock M, Kosch M, SuelakB, Witta J. Vessel wall alterations in patients with renal failure. Hypertension Research. 2000 Jan; 23: 1:3-6. doi: 10.1291/hypres.23.3.

[17] Murphy SW and Foley RN. Cardiac disease in dialysis patients, Divalent Ion abnormalities and Hyperparathyroidism In the Etiology of Cardiovascular Disease of Patients with Chronic Renal Failure. Semin Dialysis 1999; 12:97. doi: 10.1046/j.1525-139X.1999.00011.x.

[18] Levin A, Singer J, Thompson CR, Ross H, Lewis M. Prevalent left ventricular hypertrophy in the predialysis population: identifying opportunities for intervention. American Journal of Kidney Diseases. 1996 Mar; 27(3): 347-54. doi: 10.1016/S0272-6386(96)90357-1.

[19] Zoccali C, Benedetto FA, Mallamaci F, Tripepi G, Giacone G, Cataliotti A, *et al.* Prognostic impact of the indexation of left ventricular mass in patients undergoing dialysis. Journal of the American Society of Nephrology. 2001 Dec; 12(12): 2768-74. doi: 10.1681/ASN.V12122768.

[20] Norris KC. Avoiding the risks of secondary hyperparathyroidism in chronic renal failure: A new approach, and a review. Dialysis & Transplantation.

DOI: https://doi.org/10.54393/pjhs.v4i03.641

2001; 30(6): 355-67.

[21] Drazner MH, Rame JE, Marino EK, Gottdiener JS, Kitzman DW, Gardin JM, *et al*. Increased left ventricular mass is a risk factor for the development of a depressed left ventricular ejection fraction within five years: the Cardiovascular Health Study. Journal of the American College of Cardiology. 2004 Jun; 43(12): 2207-15. doi: 10.1016/j.jacc.2003.11.064.

[22] Ulasi II, Arodiwe EB, Ijoma CK. Left ventricular hypertrophy in African Black patients with chronic renal failure at first evaluation. Ethnicity & Disease. 2006 Oct; 16(4): 859-64.

[23] Tian JP, Wang T, Wang H, Cheng LT, Tian XK, Lindholm B, *et al*. The prevalence of left ventricular hypertrophy in Chinese hemodialysis patients is higher than that in peritoneal dialysis patients. Renal failure. 2008 Jan; 30(4): 391-400. doi: 10.1080/08860220801964178.

[24] Kadiri ME, Nechba RB, Zajjari YR, Kabbaj D, Bouzerda M, Oualim Z. Association of adequate dialysis parameters with left ventricular hypertrophy in hemodialysis patients. Saudi Journal of Kidney Diseases and Transplantation. 2011 Nov; 22(6): 1133-41.

[25] Kawamura M, Fijimoto S, Hisanaga S, Yamamoto Y, Eto T. Incidence, outcome, and risk factors of cerebrovascular events in patients undergoing maintenance hemodialysis. American Journal of Kidney Diseases. 1998 Jun; 31(6): 991-6. doi: 10.1053/ajkd.1998.v31.pm9631844.

[26] Barre PE, Taylor R, Parfrey PS. Risk factors for the development of left ventricular hypertrophy in a prospectively followed cohort of dialysis patients. Journal of the American Society of Nephrology. 1994 Jan; 4(7): 1486-90. doi: 10.1681/ASN.V471486.

[27] Ulasi II, Arodiwe EB, Ijoma CK. Left ventricular hypertrophy in African Black patients with chronic renal failure at first evaluation. Ethnicity & disease. 2006 Oct; 16(4): 859-64.

[28] Sniderman AD, Silberberg JS, Prichard S. Anemia and left ventricular function in end stage renal disease, in Parfrey, Harnett JD (eds): Cardiac Dysfunction in chronic uremia. Boston MA Kluwer Academic. 1992: 161-71. doi: 10.1007/978-1-4615-3902-5_10.

[29] Silverberg DS, Wexler D, Blum M, Keren G, Sheps D, Leibovitch E, *et al*. The use of subcutaneous erythropoietin and intravenous iron for the treatment of the anemia of severe, resistant congestive heart failure improves cardiac and renal function and functional cardiac class, and markedly reduces hospitalizations. Journal of the American College of Cardiology. 2000 Jun; 35(7): 1737-44. doi: 10.1016/S0735-1097(00)00613-6.